9.4

Multiplying Rational Expressions Involving Polynomials

A **polynomial** is the SUM/DIFFERENCE of one or more binomials. You MUST consider them as a GROUP when factoring.

Steps:
1) Factor the numerators and denominators separately
2) Multiply- leave as a product of factors
2) Cancel out any factors that are in common to both the numerator and denominator

1. $\frac{4x^2-4x}{x^2+2x-3}\cdot\frac{x^2+x-6}{4x}$

$\frac{4x(x-1)}{(x-1)(x+3)}\cdot\frac{(x-2)(x+3)}{4x}=(x-2)$

$x^2+3x-2x-6$
$x(x+3)\ -2(x+3)$

$x^2+3x-1x-3$
$x(x+3)\ -1(x+3)$

2. $\frac{27x^3-3x}{3x^2-2x-1}\cdot\frac{3x^2-4x+1}{3x}$

$\frac{3x(9x^2-1)}{(3x+1)(x-1)}\cdot\frac{(3x-1)(x-1)}{3x}$

$9x^2+3x-3x-1$
$3x(3x+1)\ -1(3x+1)$

$3x^2-3x+1x-1$
$3x(x-1)\ +1(x-1)$

3. $\frac{x+3}{4x^2+7x-15}\cdot 4x+5$

$\frac{(x+3)}{(4x-5)(x+3)}\cdot\frac{(4x+5)}{1}=\frac{(4x+5)}{(4x-5)}$

$4x^2+12x-5x-15$
$4x(x+3)\ -5(x+3)$

$\frac{3x(3x+1)(3x-1)}{(3x+1)(x-1)}\cdot\frac{(3x-1)(x-1)}{3x}$

$(3x-1)(3x-1)$

4. $\frac{2x^2-4x}{x^2-5x+6}\cdot\frac{x^2-4x+3}{2x}$

$\frac{2x(x-2)}{(x-2)(x-3)}\cdot\frac{(x-1)(x-3)}{2x}=(x-1)$

$x^2-3x-1x+3$
$x(x-3)\ -1(x-3)$

$x^2-3x-2x+6$
$x(x-3)\ -2(x-3)$

9.4

Dividing Rational Expression

a·c / b

Diving by a rational expression is the same as

multiplying by the reciprocal

8 / −4, −2 / −6 → $x^2-4x-2x+8$ | $x(x-4)$ | $-2(x-4)$

1. $\frac{5x}{3x-12} \div \frac{x^2-2x}{x^2-6x+8} = \frac{5x}{3x-12} \cdot \frac{x^2-6x+8}{x^2-2x}$

$\frac{5x}{3(x-4)} \cdot \frac{(x-2)(x-4)}{x(x-2)} = \boxed{\frac{5}{3}}$

Steps:
1) "Flip" the 2nd fraction.
2) Factor the numerators and denominators separately
3) Multiply- leave as a product of factors
4) Cancel out any factors that are in common to both the numerator and denominator

2. $\frac{8x^2+10x-3}{4x^2} \div (4x^2-x) = \frac{8x^2+10x-3}{4x^2} \cdot \frac{1}{4x^2-x}$

$\frac{(4x-1)(2x+3)}{4x^2} \cdot \frac{1}{x(4x-1)} = \boxed{\frac{2x+3}{4x^3}}$

−2x / 12, −2 / 10 → $8x^2+12x-2x-3$ | $4x(2x+3)$ | $-1(2x+3)$

3. $\frac{3}{4x-8} \div \frac{x^2+3x}{x^2+x-6}$

$\frac{3}{4(x-2)} \cdot \frac{x^2+x-6}{x^2+3x}$

−6 / 3, −2 / 1 → $x^2+3x-2x-6$ | $x(x+3)$ | $-2(x+3)$

$\frac{3}{4(x-2)} \cdot \frac{(x-2)(x+3)}{x(x+3)} = \boxed{\frac{3}{4x}}$

4. $\frac{x}{x+3} \cdot (4x+1) \div \frac{16x^2-1}{x+3}$

$\frac{x}{x+3} \cdot \frac{(4x+1)}{1} \cdot \frac{(x+3)}{16x^2-1} = \frac{x}{(x+3)} \cdot \frac{(4x+1)}{1} \cdot \frac{(x+3)}{(4x-1)(4x+1)} = \boxed{\frac{x}{4x-1}}$

−16 / 4, −4 / 0 → $16x^2+4x-4x-1$ | $4x(4x+1)$ | $-1(4x+1)$